



**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Applicants : T. Hayashida, *et al.*  
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For : HOT ROLLED STEEL SHEET EXCELLENT IN  
CHEMICAL CONVERTIBILITY AND METHOD OF  
PRODUCTION OF SAME  
Examiner : Fogarty, Caitlin Anne  
Art Unit : 1793  
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**DECLARATION UNDER 37 C.F.R. §1.132**

I, Teruki Hayashida, hereby declare and state as follows:

1. I am a co-inventor of the above-identified patent application, which has been assigned to Nippon Steel Corporation, Tokyo, Japan. I have been employed by Nippon Steel Corporation at the Technical Development Bureau of Nippon Steel Corporation since 1983, and my employment duties are R & D and actual production of hot and cold steel sheets. I graduated from Kyushu University with a Master course in March of 1983.
2. I have reviewed and understand the Office Action mailed September 29, 2009, and the reference cited therein, *i.e.*, JP 2003-155541 ("JP '541"). I have also reviewed and understand the specification and the pending claims.
3. I understand that the Examiner is of the opinion that JP '541 discloses a hot rolled steel sheet excellent in chemical convertibility with a composition overlapping that of

the steel of the present invention and a process of making similar to that of the present invention.

4. The present invention provides a hot-rolled steel sheet excellent in chemical convertibility and method of production of the same. The claimed steel sheet contains specific concentrations of Si and Mn in oxides on the steel sheet surface and specific number of pits and specific level of surface roughness. The claimed steel has greatly improved chemical convertibility. The present invention further defines the specific pickling conditions for avoiding bald spots on the surface of the steel sheet. A characteristic feature of the present invention is, as claimed, that a hot rolled steel sheet excellent in chemical convertibility free from bald spots, containing, by mass%, 0.03 to 0.15% of C, 1.3 to 3.0% of Si, 1.3 to 3.0% of Mn, 0.07% or less of P, 0.01% or less of S, 0.015 to 0.1% of Al, 0.001 to 0.008% of N; and the steel sheet being free from containing Cu and Mo, and the balance of Fe and unavoidable impurities, the oxides on the steel sheet surface having, by mass%, a Si concentration of 3.5% or less and a Mn concentration of 3.5% or less, with an average roughness Ra of the steel sheet surface being 3.0  $\mu\text{m}$  or less and an average number of pits of a diameter of 1  $\mu\text{m}$  to 0.3  $\mu\text{m}$  being 5 or less in squares of the steel sheet surface when dividing it into squares of 10  $\mu\text{m}$  per side, the steel sheet obtained by pickling by dipping the steel sheet in an aqueous solution containing, by mass%, a HCl concentration of 7 to 15 %, an Fe ion concentration of 4 to 12% and a balance of metal ions other than Fe and impurities, at a solution temperature of 80 to 98°C for a dipping time such that the HCl concentration (mass %) x dipping time (sec) is 273 to 520.

Particularly, the following specific pickling conditions are very important for obtaining a hot rolled steel sheet having superior chemical convertibility free from bald spots:

- (1) controlling the HCl concentration to 7 to 15 mass%;
- (2) controlling the HCl concentration (mass%) x dipping time (sec) to 273 to 520;
- (3) controlling the Fe ion concentration to 4 to 12%; and
- (4) controlling the solution temperature to 80 to 98°C.

5. The cited reference JP '541 relates to a high strength hot rolled steel sheet having excellent corrosion resistance and stretch-flanging property, where the hot rolled steel sheet contains 0.03 to 0.10% of C, 0.05 to 1.2% of Si, 1.0 to 2.0% of Mn,  $\leq 0.05\%$  of P,  $\leq 0.01\%$  of S,  $\leq 0.005\%$  of N and 0.01 to 0.05% of Al, and optionally further contains one or

both of Ti and Nb satisfying  $-0.05 \leq \{ \text{Ti} + (48/93) \times \text{Nb} - (48/12) \times \text{C} - (48/14) \times \text{N} - (48/32) \times \text{S} \} \leq 0.2$ , and optionally further contains one or more of Cu, Ni and Ca, and the balance of Fe and unavoidable impurities. The thickness of an oxide film containing  $\text{Fe}_2\text{SiO}_4$  on the surface is less than 5  $\mu\text{m}$ , and the area ratio of a bainite-ferrite phase in the cross-sectional structure is more than 80%. In a method of producing this hot rolled steel sheet, the steel is heated to more than 1150°C, subjected to finish rolling as un-coiled so as to be completed at an  $\text{Ar}_3$  point or higher, subjected to high speed cooling to below 500°C, and then coiled at 300-500°C.

Regarding chemical convertibility, JP '541 is only concerned with evaluating the amount of phosphate coating formed on the surface of the steel sheet (*see* paragraph [0044] of JP '541). JP '541 does not teach or suggest evaluating bald spots formed on the surface of the steel sheet. JP '541 teaches that it is necessary to reduce the Si content to 1.2% or less in order to produce a steel sheet with excellent corrosion resistance undergoing chemical conversion treatment. JP '541 teaches that a steel sheet containing a high Si content is generally not desirable for securing corrosion resistance (*see* paragraph [0010] of JP '541). JP '541 also teaches that although Si is an effective element for securing strength without deteriorating frangeability, the excess amount of Si is not desirable to frangeability because the excess amount of Si will generate the polygonal ferrite phase which is typically not preferred and also it will be difficult to achieve corrosion resistance (*see* paragraph [0021] of JP '541):

[s]ince it is difficult to suppress deterioration of corrosion resistance even if the present inventive process is applied, the upper limit must be made 1.2%.

According to JP '541, the pickling of the hot-rolled steel sheet is carried out using a conventional pickling method (*e.g.*, by dipping a steel sheet in 5 % HCl solution at 80°C for around 30 seconds, paragraph [0017] JP '541). Such a pickling condition is outside the pickling conditions described by the present invention (*see* item 4 above, conditions (1) to (4)).

6. Figure 1 below provides comparative data showing the effects of pickling conditions HCl concentration (mass%) x dipping time (sec) and the solution temperature (°C) on bald spot generation on the surface of the steel sheet.

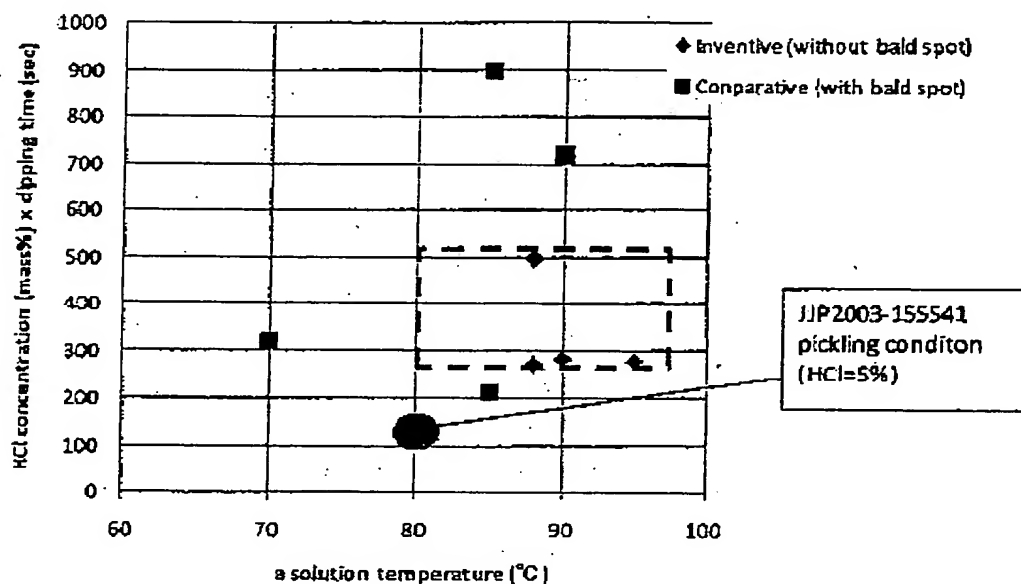


Figure 1

As it is clearly shown in Figure 1, the steel sheets obtained using conventional pickling conditions, including the steel sheets of JP '541 and comparative examples disclosed in the present application, contain bald spots on the surface of the steel sheets. The data demonstrate the importance of the pickling conditions of the present invention in producing steel sheets free of bald spots.

7. Therefore, the compositions of the steel sheets of JP '541 and the presently claimed invention do not overlap, and the processes of making the steel sheets of JP '541 and the presently claimed invention are not similar. JP '541 neither recognizes the problem of bald spot generation on the steel sheet surface, nor teaches or suggests a solution to the problem. It is my opinion that one of ordinary skill in the art following the disclosure of JP '541 would not have obtained the hot rolled steel sheet of the present invention.

\* \* \*

I hereby declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the patent or any reexamination certificate issued.

Respectfully submitted,

Date: \_\_\_\_\_

2010/3/11

*Teruki Hayashida*

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Teruki Hayashida